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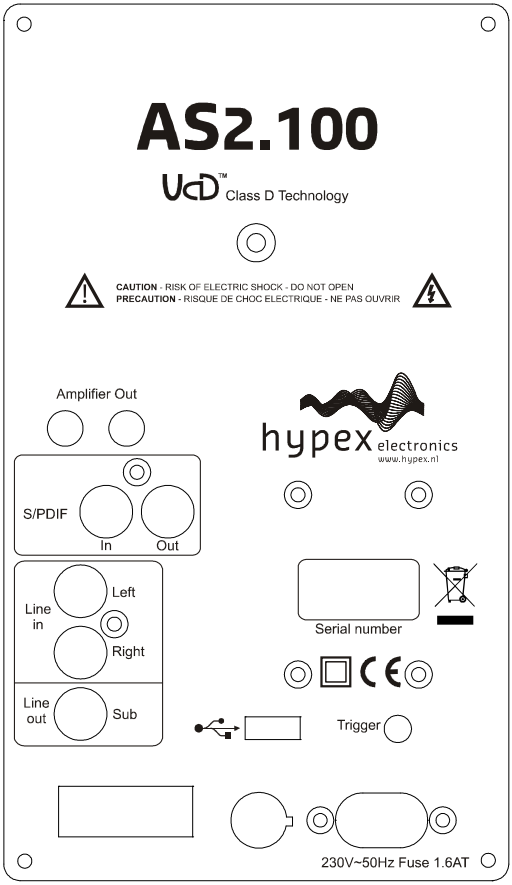
User Manual
AS2.100



Hypex AS - Series

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Product description

Type remarks

- **The first time the AS2.100 is used all biquads are zero, so there are no filters installed. Connecting any speakers and audio input at this point may cause some damage to them.**
- **Take notice on what changes you make, changing a 2channel modules to stereo setup can damage your speakers because both channels may be full range!**
- **After updating the firmware please be sure to also download the latest version of the manual from our website**

Firmware version 1.2 (August 2009)

Key features

- Compact design
- Personal Computer controlled
- Two UcD100 power amplifiers
- Pop-free start and stop control
- Stereo analogue input
- Subwoofer output
- Fully user customised filtering
- Button panel controlled
- Remote controlled
- Link communication master / slave (only with two modules)
- Low signal to noise (-100dB)

Optional features, by adding a digital audio board.

- SPDIF stereo audio input
- Input sample rates up to 192kHz
- Link communication trough SPDIF link cable (one cable for audio and link)
- USB audio input
- Low signal to noise (-104dB)

Applications

With one module the following applications can be set up, further explained in the “Hardware part” chapter :

- Stereo passive filtered system
- Briged mode for single subwoofer (max 140Watt into 4 Ohms)
- Mono/mid 2-way setup (tweeter + sub)

When two modules are used the following applications can be set up, also explained in “Hardware part”:

- 2-way active filtered stereo system
- 2 channel system with active subwoofer
- 2 channel system, both modules in bridge mode for more power

All setups are both possible with analogue and optional with the digital audio inputs SPDIF and USB.

Note that all setups have the ability to use an extra channel by connecting a active subwoofer to the subout. By this you will have the opportunity to build a 3-way system.

Connections

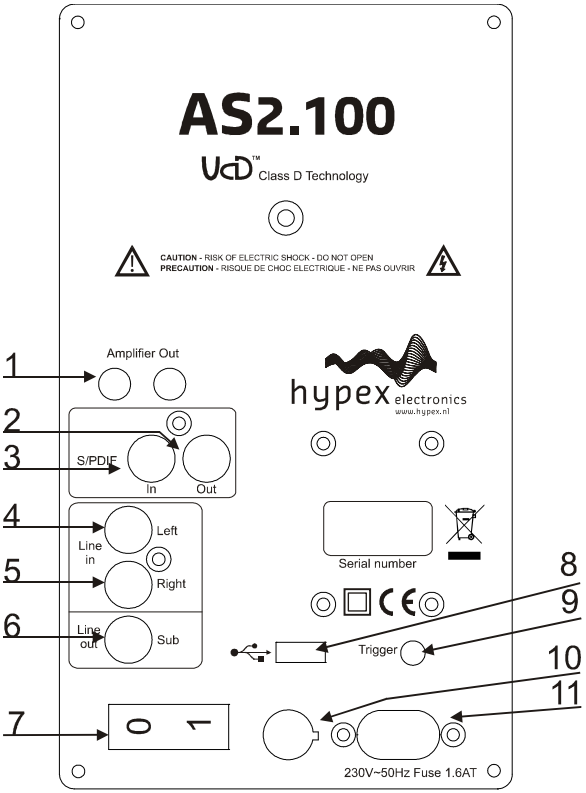


Figure 1

Overview of the connections on the front of the AS2.100.

	Function
1	Amplifier output, for slave speaker in stereo setup
4	Analogue input left channel
5	Analogue input right channel
6	Subwoofer output
7	On/Off switch
8a	USB control input
9	Master trigger output, slave trigger input Right channel trough
10	Main Fuse

11	~230 volt input
Digital version only:	
2	SPDIF audio input
3	SPDIF audio output Audio trough for slave module
8b	USB audio input

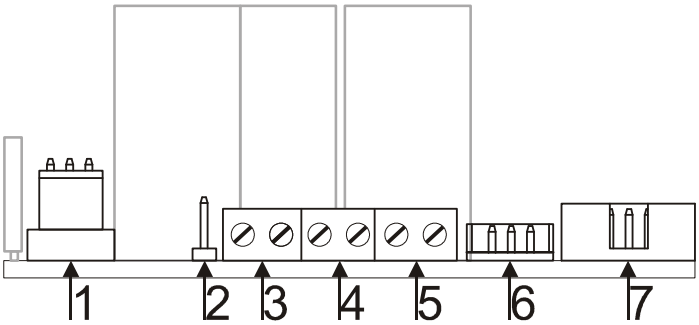


Figure 2

Overview of the connections on the back of the AS2.100.

	Function
1	Transformer connection
2	JP1, Bridge jumper
3	J4, Stereo=Left channel output 2 channel=Low channel Pin1 (left) = Speaker - Pin 2 (right) = Speaker +
4	J2, Stereo=Right channel output 2 channel=High channel Pin1 (left) = Speaker - Pin 2 (right) = Speaker +
5	J3, Connection of banana plugs Physically the same as connector J2
6	Transformer connection
7	Control panel flat-cable connector

System information

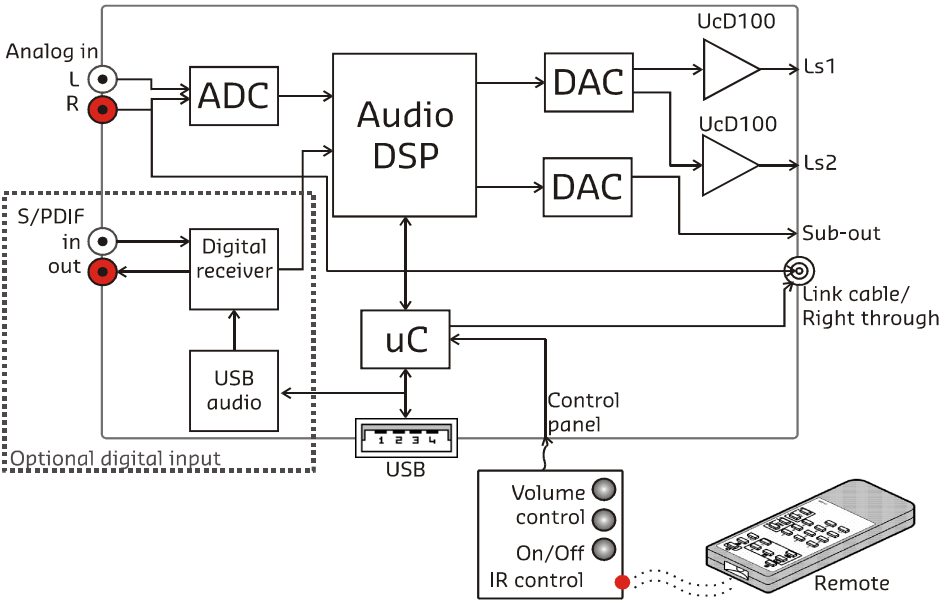


Figure 3

Description

The "AS2.100" is a plate amp for use in powered speaker systems. As an active speaker controller, a AS2.100 can form the basis of a powerful active two-way monitor. In stereo mode one AS2.100 will power an active master / passive slave pair. Finally, the module may also be used as a one-way 140W amplifier. All signal processing, including volume control, is done using the on-board DSP (digital signal processor).
Figure 1 shows the block diagram of the amplifier. When two modules are used, the second unit slaves to the first unit (master) through a link cable. The link cable (a stereo mini jack cable) carries both the right audio channel and control data. This way, both units respond to the master's control panel.
A PC controls the AS2.100 through the USB port. This connection is used to upload the configuration and filter settings. An optional board permits use of the USB link for audio as well as an SPDIF link. In digital mode, master/slave linking is done through the SPDIF in/out connections instead of the mini jack cable.

Hardware Architecture

The standard version of the AS2.100 has a stereo analogue audio input. This analogue signal is converted to digital, processed by the DSP and then converted back to analogue. A microcontroller controls the DSP, reads the control panel and communicates with the PC and/or another AS2.100 that may be attached.

Digital audio input

The optional digital input board plugs into the main PCB and carries two RCA connectors, SPDIF in and SPDIF through. Incoming SPDIF is linked through directly to the output and sent to the DSP through an asynchronous sample rate converter (ASRC) for jitter removal. The USB part adds a hub and an audio device which in turn also transmits audio over the ASRC to the DSP. The ASRC chip scans its input for whichever signal is active. In a stereo setup and in digital mode the SPDIF through cable doubles as a master/slave link, obviating the need for the mini jack cable. The mini jack cable remains functional though and does not have to be removed.

Audio performance data

MBW=20kHz, unless otherwise noted. All filters set to unity. Noise levels unweighted.

Item	Symbol	Min	Typ	Max	Unit	Notes
Input level	Vin		2.2		V	
Input impedance			10k		Ohm	Analogue cinch inputs
Output level	LS1			100	W	Into 4 Ohms
	LS2			100	W	Into 4 Ohms
Signal/Noise	SNR		100		dB	ADC
			104		dB	DAC
Total harmonic distortion+Noise	THD+N		TBD			
Analogue sampling rate	Fs		48		kHz	
Delay per channel		0	0	340,3	cm	Set in software, not for subout channel
		0	0	1000	us	
Supported digital sampling rates	Fs	32, 44.1, 48, 88.2, 96, 192			kHz	All input rates converted to 48kHz
Gain			20		dB	volume at 0dB

Remote control

The master unit is fitted with small control panel which is placed on the front of the loudspeaker cabinet. Volume and standby/on is controlled by the pushbuttons and by a infra red remote control. When 2 AS2.100 modules are used only **one** control panel is needed, cause the trigger communication between master and slave.
There is also an touch panel available at www.hypexshop.com. This can replace the standard control panel.

Product overview

Before you can use the AS2.100 in your particular setup, you first have to set the right settings. This is done by pc software, called Hypex DSP filter design.
Please do not connect any speakers to your system jet!

When you want to set up a system with the AS2.100 you apparently know what you want. So with this information you can setup your system as follows:

Hardware part

Stereo setup: Connect the module to your pc by a USB cable and select on witch side of the room your master module will be, the speaker with the AS2.100. When your master is the left channel the slave will become the right channel. When you want to set the master as right channel with analogue input you will have to change the input cinches, left in the right cinch and right in the left. This is because only the right channel is linked trough, so if you want the left channel to be linked trough you just switch left and right. For digital sources the left and right channel are linked.

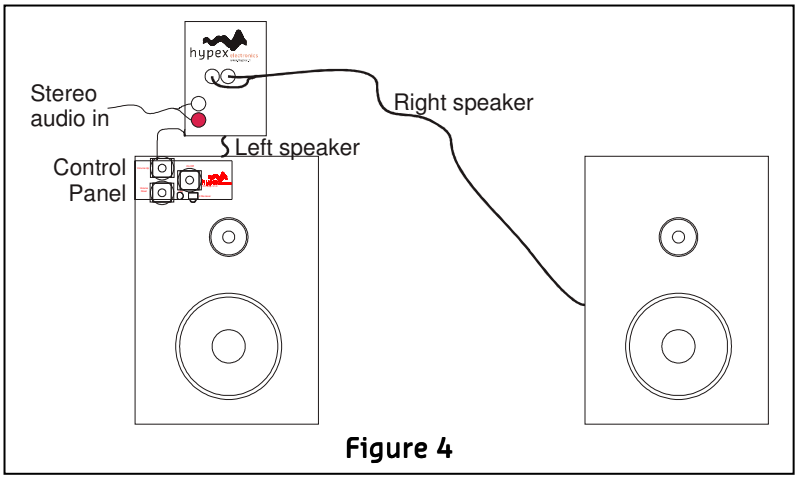


Figure 4

Bridged setup: Connect the module to your pc by a USB cable and select where the master module is placed, master module is left or right audio or functions as a subwoofer. When you use 2 AS2.100 for a stereo bridged setup you will also have to initialise the second (slave) module, see example in the last chapter of this document.
In bridged mode the jumper (see figure 2) must be placed and the speaker

must be connected between J4 speaker+ and J2 speaker+. In all other setups the jumper is not placed!
When you want to set the master as right channel with analogue input you will have to change the input cinches, left in the right cinch and right in the left. This is because only the right channel is linked trough, so if you want the left channel to be linked trough you just switch left and right. For digital sources the left and right channel are linked.

2 Channel: Connect the module to your pc by a USB cable and select what kind of 2 channel you want to setup. When you want to set the master as right channel with analogue input you will have to change the input cinches, left in the right cinch and right in the left. This is because only the right channel is linked trough, so if you want the left channel to be linked trough you just switch left and right. For digital sources the left and right channel are linked. An example is given in the last chapter of this document.

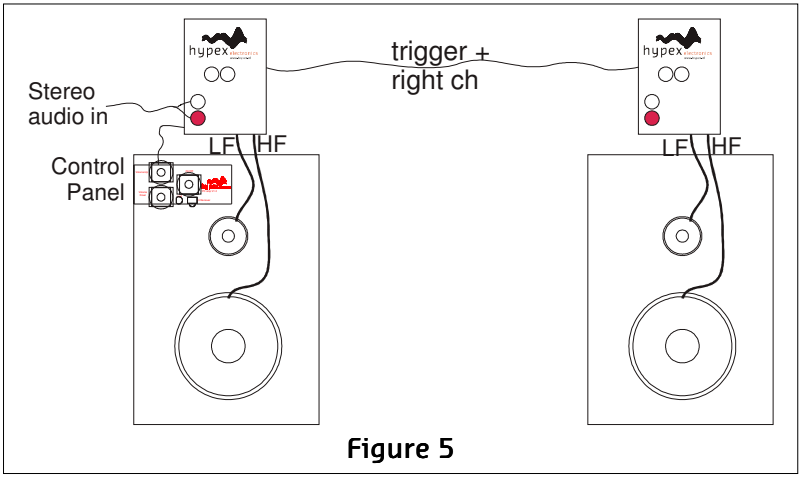


Figure 5

On all setups there is also the ability to use the Line out sub. This can source an active subwoofer module.
When 2 modules are used these two can be linked by a trigger cable. This cable holds device data and also carries a audio channel on analogue source. If the digital board is installed then the SPDIF link cable can be used to communicate between the 2 modules. This cable is placed from master SPDIF out to slave SPDIF in cinch. The trigger cable is no longer needed in this setup. On USB audio input on the master the SPDIF output is also used for linking master to slave.

Software installation

System requirements:

- Pentium class or higher
- 64MB RAM
- USB1.0 or higher

Tested on Windows XP and Vista

All files are compressed in the setup.zip file. This zip file contains 2 DLL files for communication and a .EXE file, which represents the Hypex DSP filter design program.

1. Unzip the setup.zip file on your hard disk
2. Open the "Hypex DSP filter design.EXE" by double clicking the file

Control panel

Now the program is ready for use. You see the following window, called the control panel.

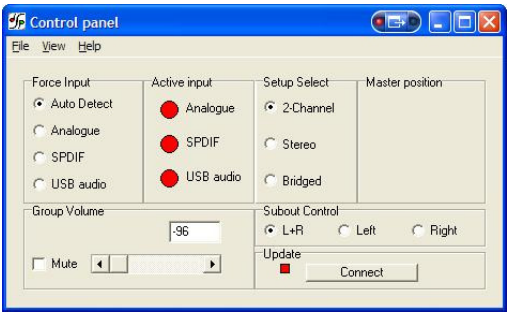


Figure 6

When the program is running connect your AS2.100 to your pc by the USB cable. Windows will automatically detect and install the AS 2.100 and the USB audio device. When the installation is done the connected window will appear and the connection light will turn green. You can also manually make a connection by the "connect" button, on the bottom right of the control panel.

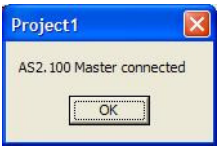


Figure 7

Now you can adapt the settings of the AS2.100 real time through USB. On the left of the control panel you see the Force input and active input groups. This shows you the settings of the audio inputs of the AS2.100, and lets you control these inputs (only when digital audio board is added).
Audio can be provided in 3 ways, analogue, SPDIF and USB audio. The selection of any of these inputs can be automatic, "auto detect". This means that when any of the inputs is presented there will be switched to this channel automatically. This is done by setting the analogue input as the standard source. During analogue in the other two inputs are scanned for any valid signal. The first channel that contains any valid audio is selected and becomes the new input source. But if you put in the USB cable but you want to use the analogue input you can force

the analogue input to be used. This can be done for all inputs, the options Analogue, SPDIF and USB Audio.
When the module selects one of the inputs this is shown by the active input lights.
Under the Setup select part the system setup can be selected. There can be chosen between:

2-channel	Stereo	Bridged
Master on the left	Master on the left	Master on the left
Master on the right*	Master on the right*	Master on the right*
Mid/Sub, L+R		Sub, L+R
Side, L-R		

* Only on digital audio board, for analogue version cinches has to be changed like described in 'Hardware part'.

The output signal of the subout channel van be controlled in the "Subout control" panel. Normally this will be set to L+R to use one subwoofer, but if you want to use a subwoofer on both sides you can set the subout to only use left or right input signal.
The last thing that can be controlled in this window is volume. This can be done by setting the scrollbar to a desired position or by typing the value in the volume field , this value is send when pressed "enter".
All of the configurations made here will be redirected from master to slave, when presented. So there is no need to connect the slave module to the pc.
The slave module is always the opposite of the master, so master left will set the slave to right. This is done automatically because the module knows whether it is master or slave.
Only when the module is switched off by remote all settings, like volume and setup, are stored in memory.

Filter design

When you want to make some filters for your module they can be designed in the "Filter design". Under view there can be switched between the control panel and the filter design window.
The following pages will give you a widespread instruction of the possibilities of the program.

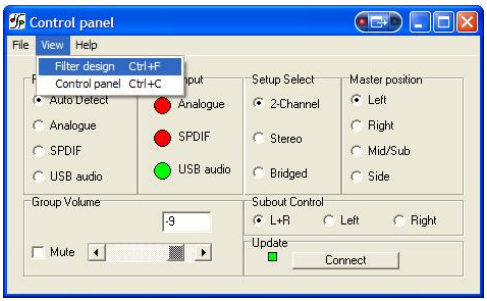


Figure 8

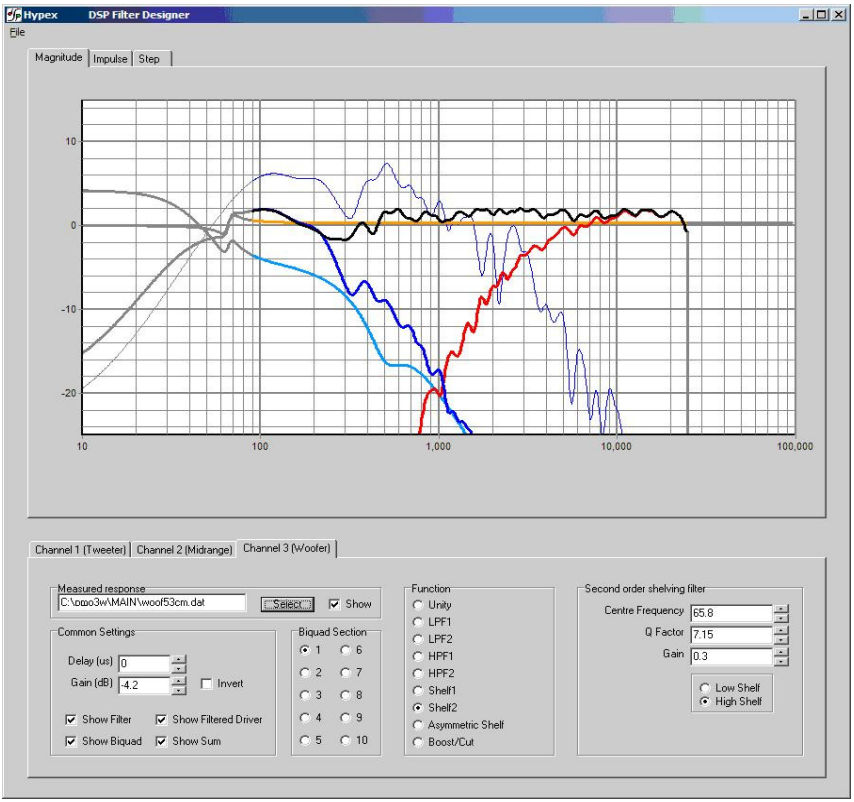


Figure 9

Graph Area

The magnitude tab shows the imported driver responses, filters, individual biquads, individual filtered driver responses and the sum.

Colour	Function
Blue, thin	Measured woofer response
Green, thin	Measured midrange response
Red. thin	Measured tweeter response
Blue, thick	Filtered woofer response
Green, thick	Filtered midrange response
Red, thick	Filtered tweeter response
Light blue, thick	Response of filter, selected channel only

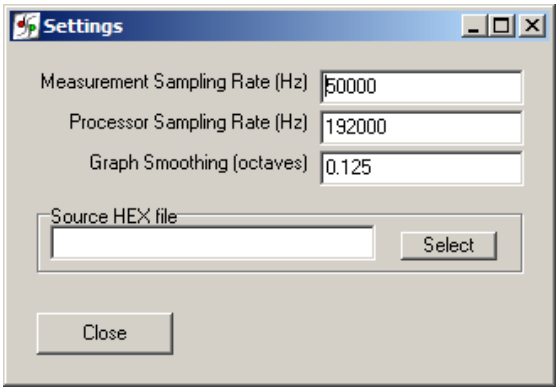
Orange, thick	Response of selected biquad
Black, thick	Sum response

Having all of these on at the same time quickly produces an intractable mess so these graphs can be separately enabled or disabled in the filter definition area.
The impulse or step tabs show the time domain response of the imported drivers and the sum response, and are used to demarcate the anechoic portion.

Filter Definition Area

The three channel tabs, labelled Tweeter, Woofer and Subwoofer are functionally identical. The top left frame is used to import response files. The "select" button opens a file. The "show" checkbox turns display of the measured graph on or off. The Common Settings box controls global gain (for each channel), delay, and the visibility of plots.
The amplified channels have up to 12 biquads, selected using the "Biquad Section" radio buttons in the middle. The Subwoofer lineout has only 6 biquads sections, for only simple filter settings. To the right is a settings area specific to the type of function selected. Unused biquads are set to unity.
The selected biquad is edited by selecting a function and setting relevant parameters.
The delay has a maximum value of 1000us for channel 1 and 2. The subwoofer channel does not include any delay. Distance is calculated by soundspeed/delay=distance, maximum distance is therefore 340,29meters/0,001secondes=34,029cm. Note that the minimum step-size is 0,708cm cause the sample rate of 48000.

Settings window



The settings window is under File > Settings... Measurement sampling rate sets the sample rate used in the imported response files (typically 48kHz). Processor sampling rate is that of the Hypex DSP hardware. Note that this setting does not control the sampling rate of the hardware. Rather, it informs the filter design application of what that sampling rate is. In short, leave this at 48kHz.
The select button opens a file dialogue box witch is not used in this application.

Work flow

Measurement

Measuring using the DSP unit set to "flat"
Perform impulse response measurements for each driver separately. Save the entire impulse record – truncation can be done later on the filter design program.
Measuring using an external amplifier
A separate amplifier may also be used for measuring the drivers, provided the amplifier's output impedance is as low as the DSP unit's.
Importing response data
Select the tab for the channel you want to import and click "select". The filter designer expects the impulse response measurement as a text file with one sample per line.
There is no restriction on the absolute gain of the impulse response data. The only thing that matters is that the absolute gain be the same for all three measurements. The filter designer computes a gain offset based on all loaded responses to centre them collectively on the vertical scale.
Truncating response data
Switch to the impulse or step response graph.

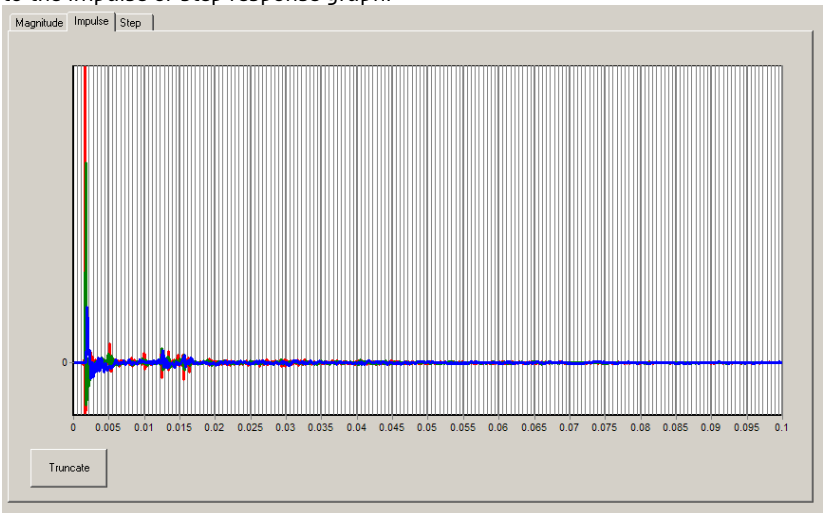


Figure 10

The first echo is apparent at 5ms. Zoom in until you see only the anechoic portion of the impulse response. Dragging the mouse, left-button down, from left to right marks a zoom area. Dragging from right to left zooms out. Dragging with the right button down pans the plot left and right.

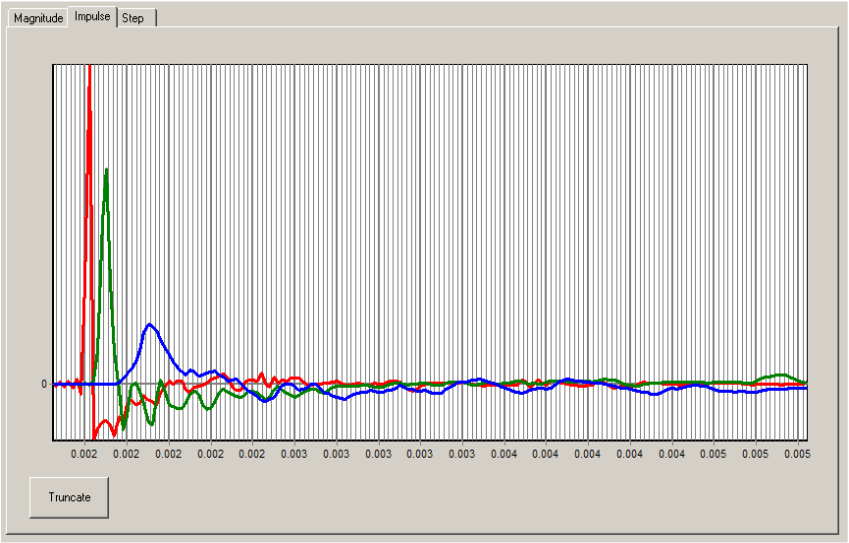


Figure 11

Click "truncate". Anything currently outside the display is drawn in grey and not processed. You will notice that in the frequency graph a portion of the low-frequency response is also drawn in grey. This is to remind the user that insufficient information is available to make *any* correction below this frequency. A way of obtaining quasi anechoic low-frequency measurements is making close-up measurements. Working with such measurements requires a good deal of interpretation but it is doable.
Important: Avoid making any corrections for which no anechoic data is available. If reflections are included, they are guaranteed to dominate the measurement at low frequencies, and you will end up making corrections for circumstances that are highly specific to the room in which the measurement was made. Power-response data can only be made in a proper echo chamber or preferably, by collating a large number of anechoic off-axis measurements. A reverberant measurement in a normal live room just won't do.

The steps of loading and truncating data can be repeated at any time. This can be particularly practical when combining close-up and far-field measurements during the filter design phase. The window in Figure 11 shows the result of this. The small knot of corrections made around 70Hz is based on close-up data first loaded separately. The LF section of the test mule is quite smooth apart from one internal standing wave.

Designing filters

Biquad function	Parameters	Use
Unity	-	Section is not used

LPF1	Cut-off frequency (always -3dB)	First order lowpass
LPF2	Cut-off frequency (asymptotically) Q	Second order lowpass. A Q of 0.71 corresponds to butterworth. 0.5 corresponds to LR2. Two identical sections with a Q of 0.71 form an LR4 filter.
HPF1	Cut-off frequency (always -3dB)	First order highpass
HPF2	Cut-off frequency (asymptotically) Q	Second order highpass. A Q of 0.71 corresponds to butterworth. 0.5 corresponds to LR2. Two identical sections with a Q of 0.71 form an LR4 filter.
Shelf1	Centre Frequency (halfway point) Gain Direction	First order shelf. Useful for baffle-step correction
Shelf2	Centre Frequency (halfway point) Gain Q Direction	Second order shelf. Useful for correcting internal cabinet resonances and for the midband peak/dip combo of most midwoofer speakers.
Asymmetric Shelf	Pole frequency and Q Zero frequency and Q	Equalising the bottom end of closed-box woofers with large magnets
Boost/Cut	Centre frequency Q gain	Dip/peak filter. For peaks, Q is defined by the poles. For dips, Q is defined by the zeros. Thus the same filter with opposite gains will cancel.

The first step is equalising the magnitude responses of the drivers flat over their entire useable frequency range.
The weapons of choice are shelving filters, and boost/cut sections. A sharp peak followed by an equally sharp dip can be corrected using a second-order shelving filter with a high Q.
Exercise care when deciding what to correct. When correcting for diffraction errors, do not exceed a Q of 3 lest the cure be worse than the ailment. Errors that are caused inside the driver, or internal cabinet resonances that emanate through the same diaphragm, may be corrected ruthlessly – provided the measurement has sufficient resolution to pin them down.
As a rule of thumb, sharp dips are diffraction artefacts while sharp peaks are caused by the drivers themselves. Exceptions are room resonances (if the response is not correctly truncated) and diffractions on repetitive patterns.
The second step is designing the actual crossover filters. All the usual strategies work. Delaying higher frequency drivers with respect to lower-frequency ones is a powerful alternative to using asymmetric slopes and yields substantially improved coherence through the crossover region.

Download

Under download the user can press "load DSP" to download its designed filters to the AS2.100.

Firmware update

Every module has the ability to update its firmware, when Hypex provides a new firmware version. The firmware version of the module is shown in the statusbar of the filter design window and under About.
The firmware can be easily updated by USB, the same for master and slave module. Under option "download" you can find "Firmware update". When this option is selected the user can select the new firmware file. This is a complete hex file provided by Hypex, no adapts can and may be made by the user!
After the file is selected the update begins.
DO NOT DISCONNECT THE MODULE AT THIS PIONT!
When the progress bar is filled the update is completed. On a CRC error the update is automatically restarted, after three errors the update is aborted.
Figure 12 shows a completed firmware update.
After restarting the module the new firmware is running.

Note that the new firmware does not have any filters installed, so the filters must be reloaded with the correct values.

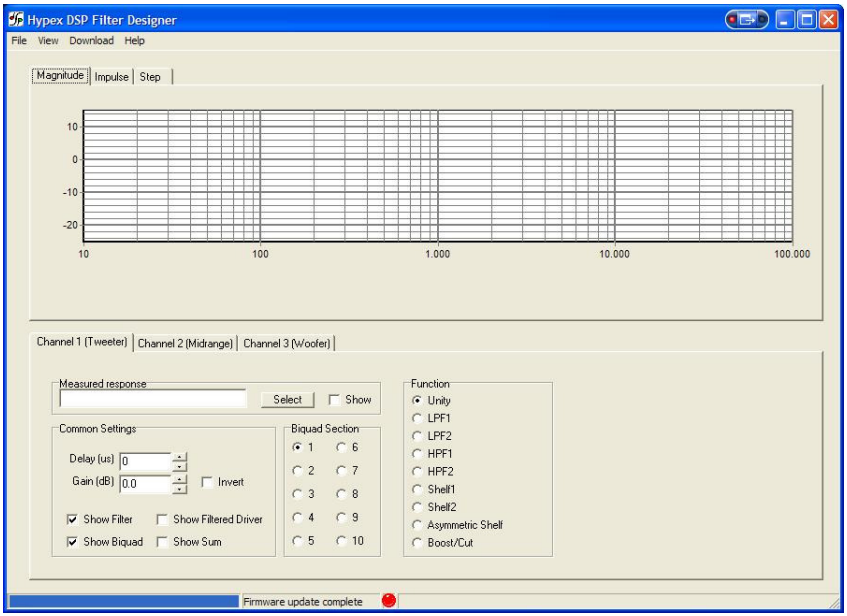


Figure 12

Examples

Example 1: 2-channel stereo setup

This example will guide you through setting up you 2-channel stereo system with the AS.100, picture of this kind of setup is given in Figure 5. The master module is always the one with the control panel connected.
First you got your 2 modules with no cables or speakers connected!.

Master

1. Plug- in the power connector and switch the module to ON
2. Power up the module by the control panel or remote
3. Start the pc program, Hypex filter design
4. Plug-in the USB cable (assumed that you've already installed the software as described in chapter "Software installation")
5. Wait for automatic connection, a popup is displayed as in Figure 7. If connection is not automatic the press the "connect" button. If there is no response there is a problem with the USB connection or your operating system that can not detect the USB device

6. Set the system to the desired setup, for this example 2-channel – where the master represents the Left speaker

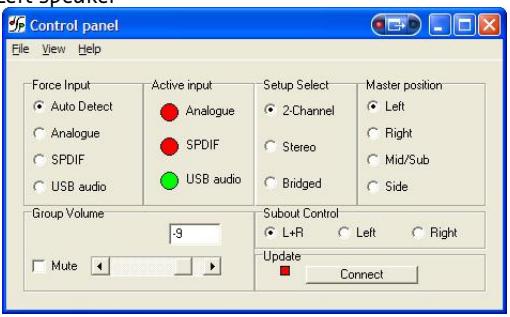


Figure 13

7. When needed set the desired input, for now just leave it Auto detect. Note that in auto detect the USB source is selected when the module is connected to the pc
8. Switch to the Filter design Window under view, or press ctrl+f
9. Fill in your biquads with the desired filters, in this preliminary software the high channel is channel 1 and the low channel is channel 2
10. Download the filters to you module under Download, or press ctrl+F9

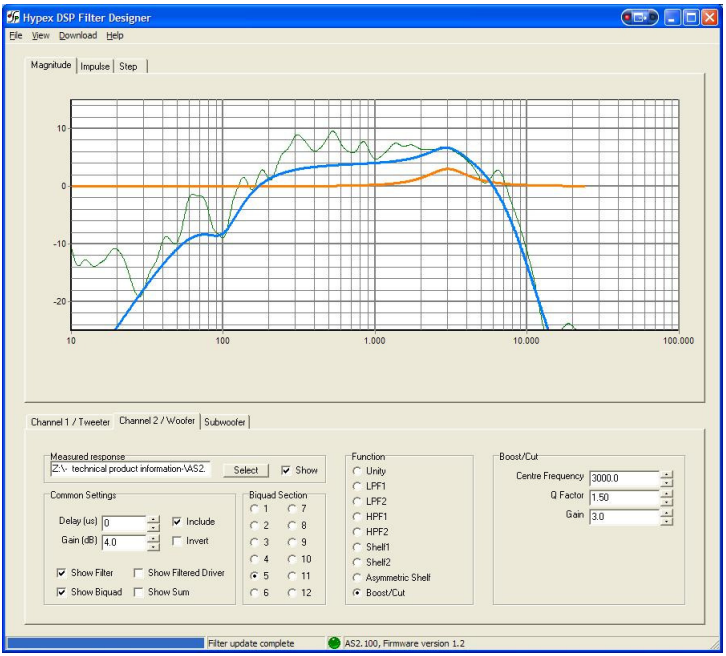


Figure 14

11. When download is completed you can power down the module
12. Start with the SLAVE module

Slave

1. Start the pc program, Hypex filter design. Or go back to the control panel (ctrl+c) if the program is still running
2. Plug- in the power connector and switch the module to ON
3. Plug-in the USB cable (assumed that you've already installed the software as described in chapter "Software installation")
4. Wait for automatic connection, now the program detects a slave module, this is shown in a popup. If connection is not automatic the press the "connect" button. If there is no response there is a problem with the USB connection
5. Switch to the Filter design Window under view, or press ctrl+f
6. Fill in your biquads with the desired filters or use the same filters as the master module. In this preliminary software the high channel is channel 1 and the low channel is channel 2
7. Download the filters to you module under Download, or press ctrl+F9

8. When download is completed you can power down the module and disconnect the USB cable
9. Master and Slave are now set up as a 2 channel stereo system

Final setup
When both modules are installed it is time to complete your setup.
- First connect your speakers as explained in chapter Product overview
- Connect the trigger cable (mini jack) **or** SPDIF cable between both modules, depending on the used audio source
- Power up master and slave module
- Turn on the master by control panel or remote
- Lower you source volume, prevent loud start-up volume
- Connect your source to the AS2.100

Ready!

Now the system is fully setup and can be controlled by the control panel, remote control or by connecting the module to your pc. From now on you can update your filters at any time, just repeat the Master and Slave steps.

* If your slave module is not turned on by the master try to power down the slave, turn the master off, wait 5 seconds, power up slave and turn the master back on
* When there is something that does not work try to repeat the installation

Example 2: Stereo setup with active subwoofer

This example describes how to set up a stereo passive filtered audio system plus an active subwoofer (with or without filtering) with use of one AS2.100. This setup is shown in Figure 4. At first you have only a AS2.100 with no cables connected.

1. Plug- in the power connector and switch the module to ON
2. Power up the module by the control panel or remote
3. Start the pc program, Hypex filter design
4. Plug-in the USB cable (assumed that you've already installed the software as described in chapter "Software installation")
5. Wait for automatic connection, a popup is displayed as in Figure 7. If connection is not automatic the press the "connect" button. If there is no response there is a problem with the USB connection or your operating system that can not detect the USB device

6. Set the system to the desired setup, for this example stereo left because the left speaker holds the AS2.100 module
7. Set the Subout control to L+R, because one subwoofer is used

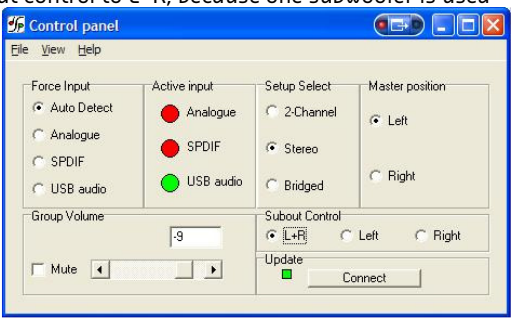


Figure 15

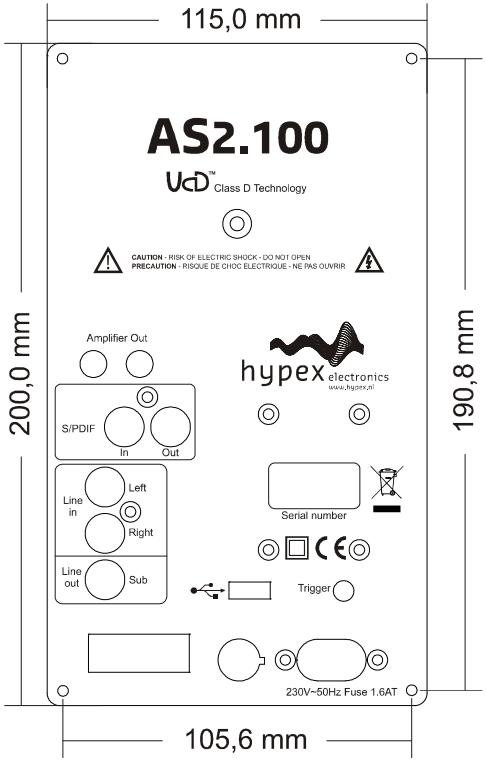
8. When needed set the desired input, for now just leave it Auto detect. Note that in auto detect the USB source is selected when the module is connected to the pc
9. Switch to the Filter design Window under view, or press ctrl+f
10. Fill in your biquads with the desired filters. For the stereo setup you don't need to set any filtering for channel 1(left speaker) and channel 2 (right speaker), but you got the ability to use them
11. Set your Subwoofer filtering if required
12. Even when you don't want to use the filters you still need to set them to unity. Press download, or use ctrl+F9
13. When the download is complete the setup is done
14. Connect the right speaker to the Amplifier out connector and your subwoofer to the Line out Sub
15. Present your audio source

Ready!

Now the system is fully setup and can be controlled by the control panel, remote control or by connecting the module to your pc. From now on you can update your filters at any time, just repeat the steps of this example.

Technical data

Supply voltage	230Volt AC/50Hz +/-10%
Dimensions	115mmx200mmx60mm (WxHxD)
Plate thickness	2,5mm
Weight	1,5 kg
Clearance	9mm



Warranty

The work carries warranty out for all provable material and production defects for the duration of 12 months starting from sales. All damage, which is caused by wrong or inappropriate operation, is excluded from the warranty.